LOCOMOTIVE & CAR EQUIPMENT DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA

9-59 (150)

PRINTED IN U. S. A.

GEJ-3805

OPERATING INSTRUCTIONS

•

8000 HP 4-UNIT DIESEL-ELECTRIC LOCOMOTIVE

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LOCOMOTIVE AND CAR EQUIPMENT DEPT.

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SUBJECT

• Change Notice #1
Instructions GEJ-3805

2000 HP D-E LOCOMOTIVES
GE Serial Nos. 32218 thru 32221
GE Reqn. 413-67924
Furnished: Union Pacific Railroad

COPIES
CS Bressler (1), Omaha
CJ Kline (6), Salt Lake City

Erie, October 22, 1959

Union Pacific Railroad (100 copies)
Omaha 2, Nebraska
Att: Mr. G.T. Wickstrom

Attached is change material for insertion in the Operating Instructions sent to you for the above equipment.

1. Destroy contents page: 3-4

   Insert revised contents page: 3-4 (Supplemented 11/59).
   *Supplement adds section on DRAINING COOLING SYSTEM.

2. Destroy page: 43

   Insert revised page: 43-44 (Supplemented 11/59).
   *Additional section covering DRAINING COOLING SYSTEM in Above and Sub-Freezing Weather.

We suggest that this letter be filed in front of each book as a record of revisions performed.

L.S. Francis

L.S. Francis
Customer Education, Railroad Locomotive, 4-14, Ext. 2524
LOCOMOTIVE AND CAR EQUIPMENT DEPARTMENT

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Do not order parts from plates in this publication.

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GENERAL ELECTRIC

ERIE, PA.

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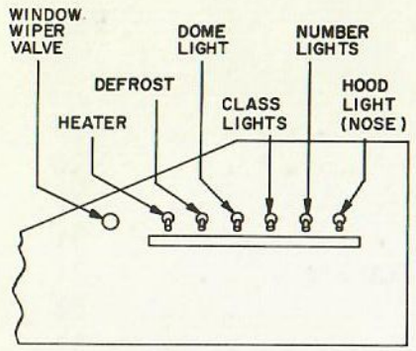
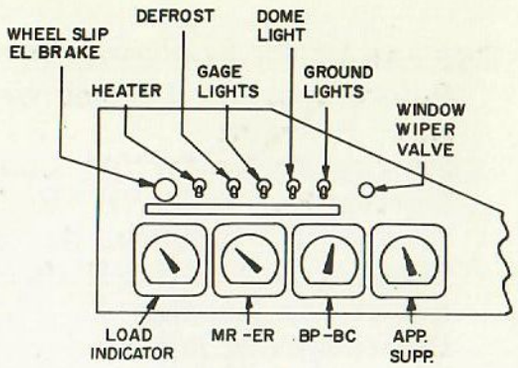
*Supplemented 11/59

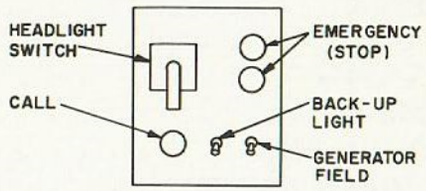
OPERATING HANDLES



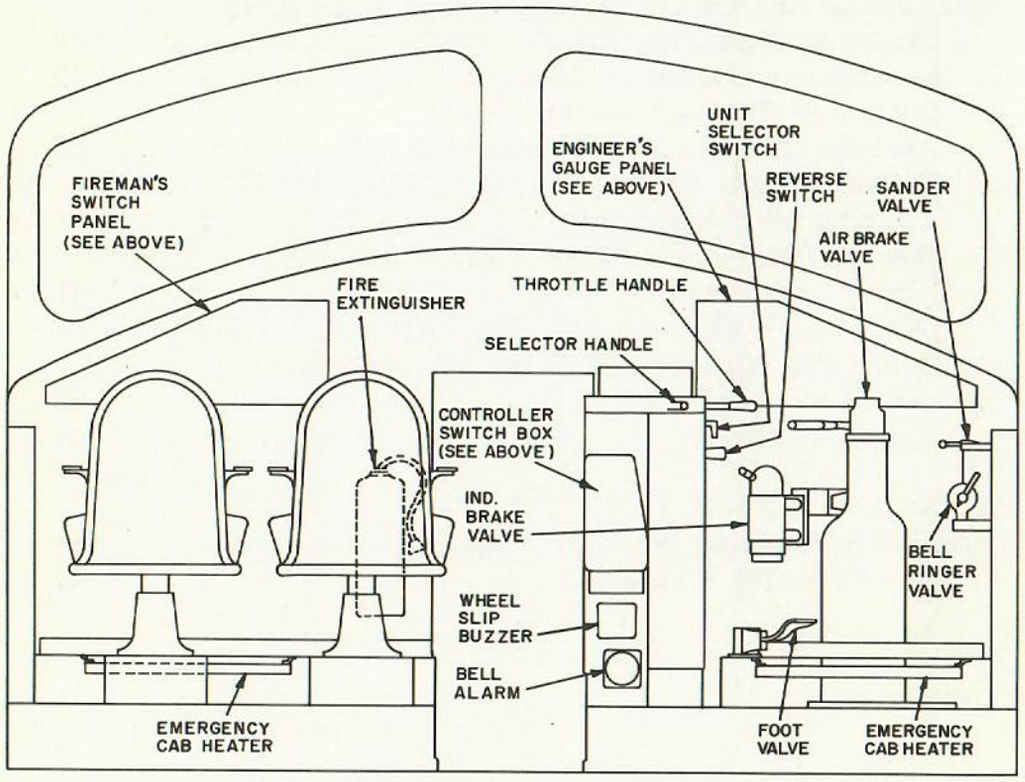
FIREMAN'S SWITCH PANEL



ENGINEER'S GAUGE PANEL



CONTROLLER SWITCH BOX



OPERATOR'S CAB
Fig. 1

OPERATING HANDLES

THROTTLE HANDLE (Fig. 1)

1. Has an IDLE position and eight running notches. Throttle position is indicated above handle.

   a. Can be moved from IDLE position only with selector handle in 1, 2, 3, or 4, and reverse handle installed.

   b. Advance throttle handle through each notch slowly. Return to IDLE as rapidly as desired.

SELECTOR HANDLE (Fig. 1)

Has an OFF position and four MOTORING positions to the left - position shown by indicator at top of controller. Handle in OFF position disconnects traction motor power circuits.

Can be moved from OFF to No. 1 regardless of reverse handle position. Can be moved to position 2, 3, or 4, only when reverse handle is in FORWARD or REVERSE. Can be moved from 1 to OFF only with throttle in IDLE. See TRANSITION under OPERATING PROCEDURE.

REVERSE HANDLE (Fig. 1)

1. Has three positions: FORWARD, OFF and REVERSE.

   a. Can be moved only with throttle handle in IDLE and selector handle in OFF or motoring position No. 1.

   b. Can be installed or removed only when in OFF position.

BRAKE EQUIPMENT

HAND BRAKE

1. In "A" units - located in rear of locomotive on engineer's side.

2. In "B" units - located on No. 1 end of locomotive on "B" side.

To apply:

Turn the handwheel clockwise until the brake is fully applied.

To release:

Disengage ratchet. Turn wheel counter-clockwise until brakes are fully released.

AIR BRAKES

24RL brake equipment is used on locomotives.

The equipment consists primarily of the automatic brake valve, independent brake valve, brake pipe cutout cock, feed valve, and D-24 control valve.

1. The automatic brake valve handle controls train and locomotive brakes. It has six positions:

   a. Release - Controlled full release is obtained in which the large capacity feed valve provides a high rate of air flow to the brake pipe at feed valve pressure without the liability of overcharge.

   b. Running - Releases brakes when the brakes are charged and ready for use and when the brakes are not being operated.

   c. First Service - Provides for an initial normal service rate of brake pipe reduction to initiate quick service on train brakes, after which a slower rate is imposed. This allows the brake pipe pressure to readjust itself throughout the train thus avoiding a heavy reduction at the front end.

   d. Lap - Holds brakes applied after a service application until it is desired either to make a further brake pipe reduction or to release the brakes.

   e. Service - Causes the locomotive brakes and train brakes to apply uniformly on both a time and pressure basis by delaying the beginning of effective brake cylinder pressure development on the locomotive to coincide with that on the train.

   f. Emergency - Applications are adjustable to provide slack control according to the services (Rotair Valve position). This feature provides a rapid development of locomotive brake cylinder pressure for short trains; or a controlled buildup for long trains.

2. The independent brake valve handle controls locomotive brakes only. This handle has a release position and an application zone. Leakage is automatically controlled which insures that the brake will not release due to leakage. When the brake valve handle is set in any position of the application zone, the valve will automatically lap when the applied pressure reaches the value corresponding to the position of the handle. The locomotive brakes may be released after an automatic application by depressing the independent brake valve handle in any position. Brakes will reapply to the setting of the handle when the handle is released.

3. First service cock on the back side of the automatic brake valve is used for cutting in or out the first service operation of the brake-valve. When the handle is toward the operator, it is cut in.

4. Selector cock on the rotary valve seat portion has two positions: "MR", main reservoir (handle away from operator) and "FV", feed valve (handle toward operator). With the handle on MR and the automatic brake valve handle in release position, main reservoir air flows to the brake pipe un-

affected by the regulating portion of the feed valve and overcharging is possible. When the handle is moved to FV position and the automatic brake valve in release or running position the brake pipe is connected to the control pipe and feed valve pressure will be maintained in the brake pipe.

5. Brake pipe cutout cock on the lower portion of the automatic brake valve is used for cutting the brake valve in or out. When the handle is pointing toward the operator the brake valve is cut in (Open), and away from operator it is cut out (Close).

6. Safety control cutout cock on the service application portion is used to cut in or out all safety devices (safety control, locomotive overspeed and train control, if used). With the handle down, all safety devices are cut in.

7. Maintaining cutout cock is located near the double heading cock and is out with the handle in the "Out" position. This cock must be cut "Out" to test for brake pipe leakage.

8. Rotair valve located below the operator's instrument panel is a manually operated selector valve having four positions: freight, freight lap, passenger, and passenger lap. The control should be in PASS position for short freight trains and when handling light locomotives. The class of the freight train with reference to speed should be considered when FRGT position is selected. On a heavy freight train of 50 cars or more operating at top speeds of 30 to 35 miles per hour the control should be in FRGT position, but on trains operating at higher speeds the control should not be placed in FRGT position until train length exceeds about 70 cars. On trailing A units, valve handle should be in FRGT LAP or PASS LAP depending on whether leading A unit valve is in FRGT or PASS.

9. Control valve, located in the nose of A units and in the rear of B units, when actuated by the brake valve, operates to charge, apply and release the brakes. The control valve in B units includes the

controlled emergency cock which should be positioned at F or P to correspond with the position of the Rotair valve in the leading A unit. Common to the control valve in both A and B units are the charging changeover cock, dead engine cock and graduated release cap.

a. Charging changeover cock should be positioned at F or P to correspond with the position of the Rotair valve in the leading A unit. When in F charging of the auxiliary reservoir is at a slow rate while in P the rate is much faster.

b. Dead engine cock should be in LIVE position for normal operation and DEAD when the locomotive is hauled dead in a train.

c. Graduated release cap has two positions: graduated GRA and direct DIR. This applies to automatic release of the locomotive brakes which will usually be graduated in light freight service and direct in heavy freight.

SAFETY CONTROL

The safety control pedal is located on the floor to the left of the operator's seat. The pedal must be depressed at all times except when the locomotive is stopped and 30 pounds or more brake cylinder pressure exists. If the pedal is released during operation the safety control whistle will sound for three seconds during which time the pedal can be depressed preventing brake action. Otherwise a full service application of brakes will be made.

DYNAMIC BRAKE INTERLOCK

A dynamic brake interlock is used to release or prevent an automatic brake application on the locomotive if the dynamic brake is on. Independent application and release of locomotive brakes is available at all times regardless of dynamic brake operation. If the automatic brake valve is placed in the emergency position, or for any penalty application, the dynamic brake is nullified allowing the automatic brake valve to operate.

DYNAMIC BRAKE UNIT SELECTOR SWITCH

1. When operating all G.E. units in multiple:

   a. Place Unit Selector Switch on all units in No. 1 position.

   b. Do not install Field Loop Dynamic Braking Jumpers between units.

2. When operating G.E. units in multiple with units requiring Field Loop Dynamic Braking Jumpers:

   a. Place Unit Selector Switch on all trailing units in No. 1 position.

   b. Place Unit Selector Switch on lead unit to number corresponding with number of units in consist.

   c. Install Field Loop Dynamic Braking Jumpers between all units.

PNEUMATIC CONTROL SWITCH

The pneumatic control switch is an air operated electric switch located in the nose compartment. Any penalty application of brakes such as emergency application of brakes, safety control application of brake, train control application (if used) and locomotive overspeed will trip this switch returning engine to IDLE. The switch is reset automatically when the throttle handle is returned to IDLE and the brake recovered.

RECOVERY OF BRAKE AFTER PENALTY APPLICATION

1. Place automatic brake valve handle in LAP, SERVICE, or EMERGENCY.

2. Return throttle handle to IDLE.

3. Depress safety control pedal.

4. Allow application pipe to build up to main reservoir pressure.

5. Release brakes by returning brake valve handle to RUNNING.

LOCOMOTIVE OVERSPEED BRAKE APPLICATION

1. If the locomotive is allowed to reach a speed of more than 65 mph, the overspeed warning whistle will sound.

2. Unless the locomotive speed is reduced below 65 mph before the application pipe pressure is reduced 35 pounds below normal, an automatic brake application will occur and engine will automatically return to 1st notch speed and low power.

3. If the overspeed brake application has completely occurred, release in same manner as after penalty application. (See Recovery After Penalty Application.)

DYNAMIC-BRAKE OPERATION

1. Dynamic braking effort is controlled by the selector handle. The dynamic brake may be applied with the locomotive operating in either forward or reverse motion. The position of the pointer on the scale of the load meter indicates the amount of braking effort being developed.

   The operation and effect of the dynamic brake on the train is similar to that of the locomotive independent air brake; braking effort is applied to the locomotive only. The same precautions for bunching the slack and preventing slack run-out are required.

2. Dynamic-Braking Limits: (Automatically Regulated)

   a. Green Scale - 0 to 900 amperes - Unlimited time below 56 mph.

   b. Red Scale - 900 to 1500 amperes - Braking not permitted.

c. Above 56 mph braking must be limited to 600 amperes.

3. To apply Dynamic Braking:

a. Move throttle handle to IDLE.

b. Reverse handle must be in FORWARD or REVERSE.

c. Move selector handle to OFF and then to large B in the braking range; load-meter pointer will move slightly into braking range. Wait until engine speed has reduced to IDLE before advancing to "B" position.

d. Bunch train slack by advancing selector handle cautiously into braking range. Do not allow loadmeter pointer to exceed 100 ampere mark on the scale until all slack is "bunched".

e. After slack is bunched, advance selector handle into braking range until the desired braking effort is obtained. Make handle movement slowly.

f. The amount of braking effort varies with the train speed.

g. It is permissible to start from a standstill on a down grade with the dynamic brake applied.

h. When in dynamic-braking connection automatic air-brake application will apply to train only. In emergency air brakes can be applied to locomotive by use of independent handle.

4. Release of Dynamic Brake:

a. Reduce braking slowly; pause when the load-meter pointer indicates 100 amperes on the braking scale to prevent slack runout.

b. Handle can now be turned to OFF or MOTORING.

c. A light application of the independent air brake aids in preventing slack runout.

5. Cut-Out of Dynamic Brakes:

a. If the engine-control switch is turned to IDLE, dynamic braking on that unit is inoperative.

b. Cut out dynamic brake only when selector handle is OFF; this avoids surges on the equipment or on the train. For the same reason, dynamic brake must not be cut in except with the selector handle OFF.

AUXILIARY AIR EQUIPMENT

BELL VALVE (Fig. 1)

The bell control valve is at the operator's position. The bell and wiper cutout cock is located in the nose compartment.

HORN VALVE (Fig. 1)

The horn control valves are at the operator's position. A horn cutout cock is located in the nose compartment.

The horn valve located nearest the operator blows the horn that faces forward. The horn valve located farthest from the operator blows the horn that faces to the rear.

WINDSHIELD WIPER VALVES (Fig. 1)

Each windshield wiper is controlled by a needle valve. The wiper and bell cutout cock is located in the nose compartment.

SANDER MECHANISM AND SANDER TIMER

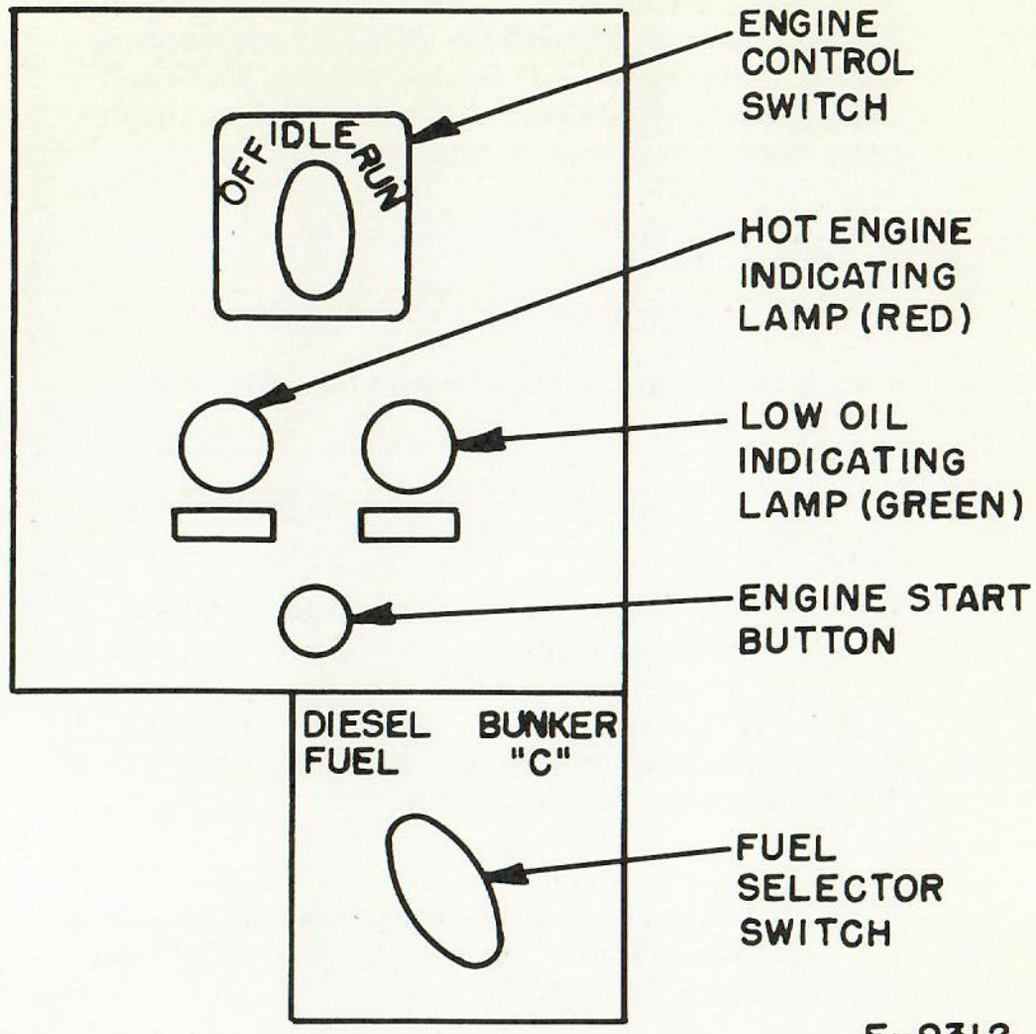
Rails are sanded normally by depressing the automatic brake valve sander bail with sander timer switch in either OFF or ON position.

Sander timer is located at operator's position.

When sander timer switch is in ON position rails are sanded automatically when wheels slip. See WHEEL SLIP under OPERATING PROCEDURE.

The sander cutout cock is located in the nose compartment.

ALARMS AND SAFEGUARDS



ENGINE START PANEL
Fig. 2

LOW LUBRICATING OIL (GREEN) LIGHT AND BELL (Fig. 2)

1. If engine lubricating-oil pressure drops to 7 - 10 psi at 400 rpm, or 16 - 21 psi at 1000 rpm, the engine shuts down, the alarm bell sounds, and the (green) low lubricating-oil lamp lights.

2. After engine shuts down, return throttle handle to IDLE. Check lubricating oil supply.

3. To restart diesel engine, depress shut-down plunger on engine governor (Fig. 7) and depress engine start button. If engine fails to start and run, release engine-start button. If in multiple unit, continue operation with unit cut out.

HOT ENGINE (RED) LIGHT AND BELL (Fig. 2)

1. Light is located on Engine Control Panel.

2. Indicates cooling water temperature exceeds 194 F.

3. Return throttle handle to IDLE and keep engine running.

4. Check radiator shutters. If stuck in CLOSED position, manually open.

5. Check that fan is running. If fan is not running, turn knob on engine temperature control switch to LOW SPEED or HIGH SPEED.

6. If cooling water temperature does not return to normal within reasonable time, shut engine down. See instructions under Operating with Lead Unit Shut Down, if applicable.

WHEEL SLIP (WHITE) LIGHT AND BUZZER (Fig. 1)

1. Light is located on Engineer's Gage Panel.

2. Indicates at least one pair of wheels is slipping.

3. Power is automatically reduced and reapplied after wheels stop spinning.

4. See WHEEL SLIP under OPERATING PROCEDURE.

GROUND RELAY AND GROUND RELAY CUTOUT SWITCH (Fig. 8)

1. If a ground occurs in the power circuits, power is removed from traction motors and engine speed automatically returns to IDLE. Indicator on the

ground relay moves to the red dot. Ground relay is located on the control compartment panel.

2. When a ground occurs:

   a. Return throttle handle to IDLE.

   b. Turn engine control switch to IDLE on affected unit.

   c. Push in reset button on ground relay.

   d. Turn engine control switch to RUN on affected unit.

   e. Move locomotive. If ground relay stays in, continue operation.

3. If ground relay continues to trip when the throttle handle is advanced to a certain notch, operation must be limited to the notch position below that at which the ground occurred.

4. If ground relay trips in all throttle handle notch positions, shut down diesel engine. UNDER EMERGENCY CONDITIONS, the locomotive may be moved under its own power by resetting the ground relay and opening the ground-relay cutout switch in the control compartment. Move slowly and no further than necessary. IF SMOKE OR OVERHEATING OF ELECTRICAL EQUIPMENT OCCURS, shut down defective unit immediately.

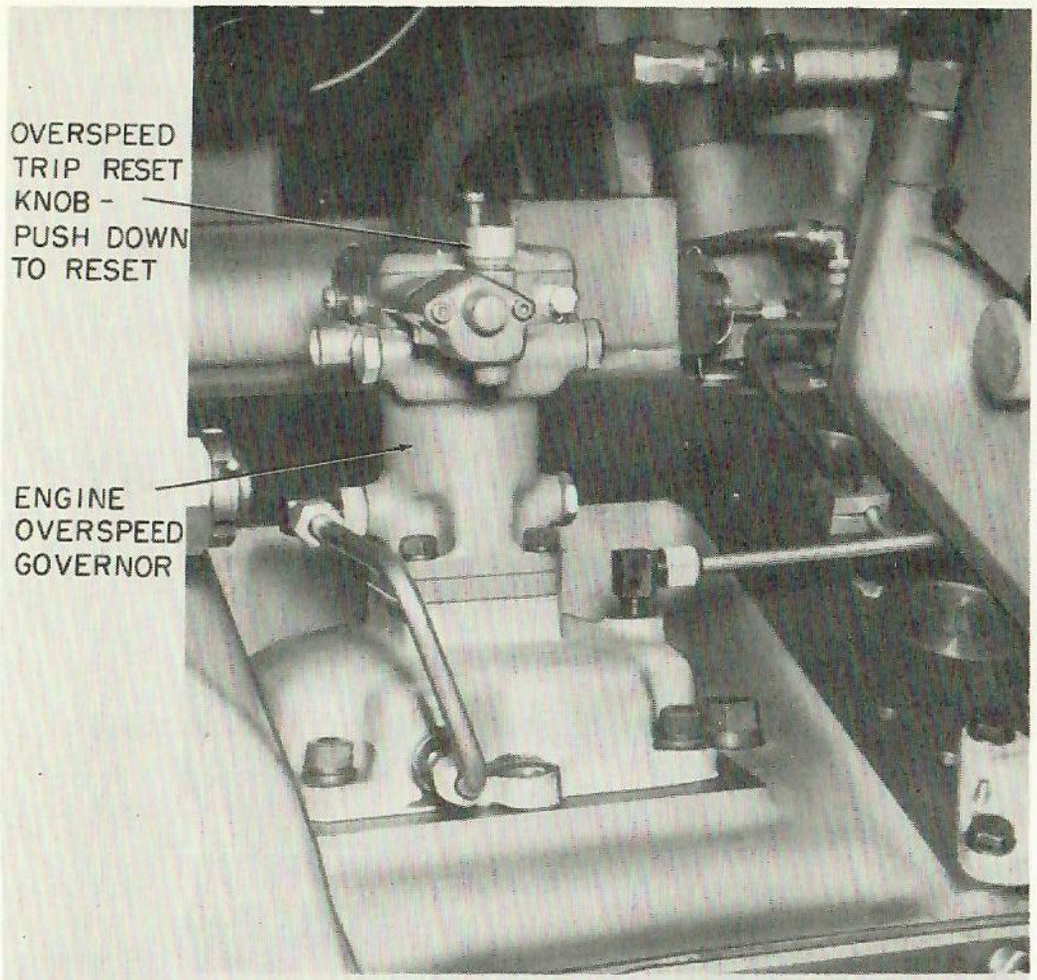
DIESEL-ENGINE OVERSPEED (Fig. 3)

1. Engine automatically shuts down when engine speed exceeds safe limits.

2. To restart engine:

   a. Move throttle handle to IDLE and engine control switch to IDLE.

   b. Reset overspeed device by depressing the knob located on the overspeed governor.



ENGINE OVERSPEED TRIP DEVICE
Fig. 3

c. Start engine and move engine control switch to RUN.

3. If overspeed switch repeatedly trips, operate in EMERGENCIES ONLY at partial load by keeping the throttle handle below notch position where tripping occurs.

ENGINE WATER TEMPERATURE CONTROL

The engine water temperature is controlled by a single radiator fan and louvers located on the right and left rear sides of the locomotive.

A temperature control panel, with a five position knob, is located in the rear of the locomotive. These positions are:

a. **FAN OFF-SHUTTERS OPEN**
In this handle position fan will not operate and shutters will remain open regardless of engine water temperature.

b. **OFF**
In this handle position fan will not operate and shutters will be closed regardless of engine water temperature.

c. **LOW SPEED**
In this handle position fan will operate at low speed and louvers will remain open.

d. **HIGH SPEED**
In this handle position fan will operate at high speed and louvers will remain open.

e. **AUTOMATIC**
For automatic operation the engine temperature control handle should be in automatic position. Louvers will not open when throttle handle is in IDLE, notch 1, or 2 position until water temperature reaches 170 F. With throttle handle in notch 3 or above, fan will operate at low speed when water temperature reaches 160 F and at high speed when water temperature reaches 170 F. Fan will shut off when temperature drops to 153 F.

CIRCUIT BREAKERS

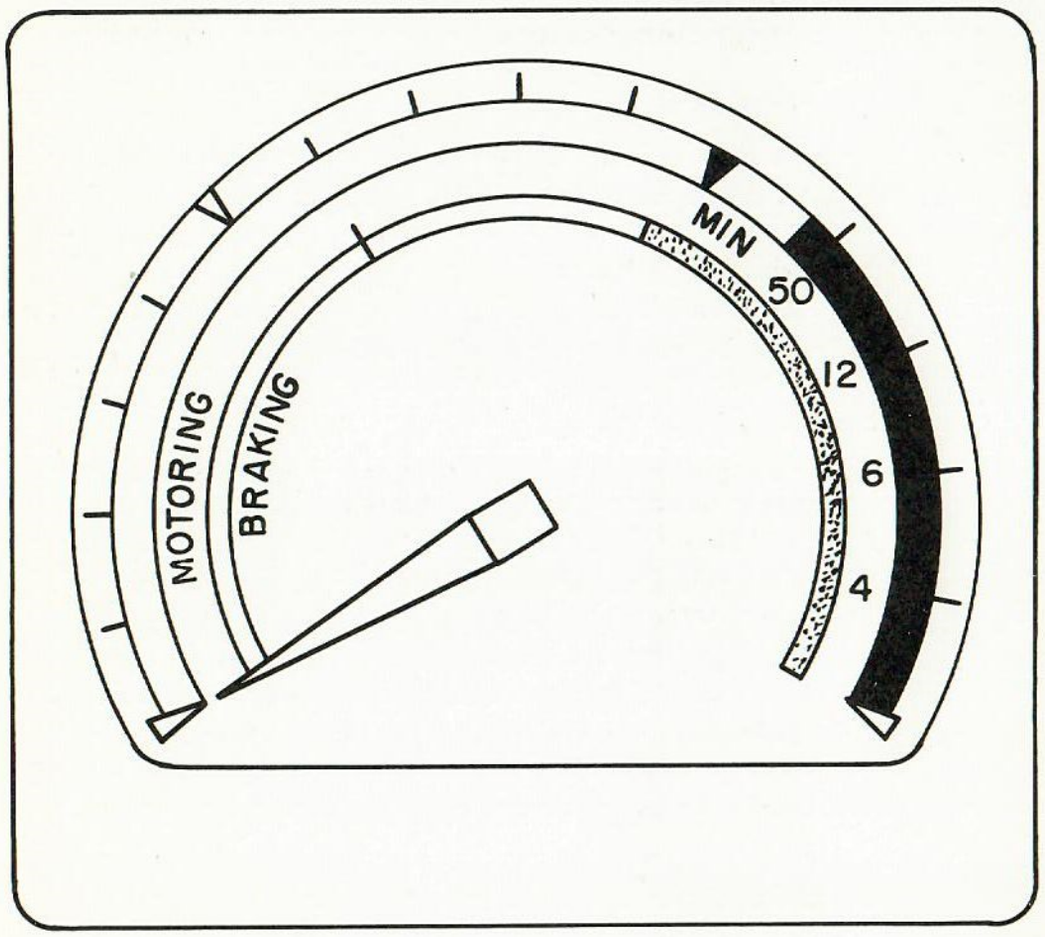
1. When an overload or short circuit occurs, breaker will "trip" and open the faulty circuit. Handle moves to the center position to indicate a tripped breaker.

2. Reset breaker by moving handle to OFF then to ON. In some cases it may be necessary to wait a few minutes before the breaker can be reset.

ALARMS AND SAFEGUARDS

On A units all circuit breakers are located on the control compartment panel.

On B units all circuit breakers, with the exception of the fuel pump and control breakers, are located on the control compartment panel. These two breakers are located on the hostler's control stand, and should be left "OFF" except when using the hostling control.



LOAD INDICATOR
Fig. 4

GAGES AND INSTRUMENTS

LOAD INDICATOR (Fig. 4)

The load indicator is a color band guide for locomotive operation.

1. The pointer position on the scale indicates the amount of load on the traction motors when pulling a train.

2. The two-color scale (green and yellow) is divided into sections with safe operating limits as follows:

   a. Green Scale - 0 to 1085 amperes - continuous operation permitted.

   b. Yellow Scale - 1085 to 1500 amperes - operation permitted only when starting and accelerating the train. A train of proper tonnage should not require more than approximately four minutes operation in this zone.

3. The braking scale is the operator's guide in applying the dynamic brake. For complete instructions see DYNAMIC BRAKE OPERATION.

4. If the loadmeter becomes inoperative do not operate locomotive in 8th notch at a speed of less than 14 mph.

BATTERY VOLTMETER

1. Voltage scale - indicates voltage of battery circuit.

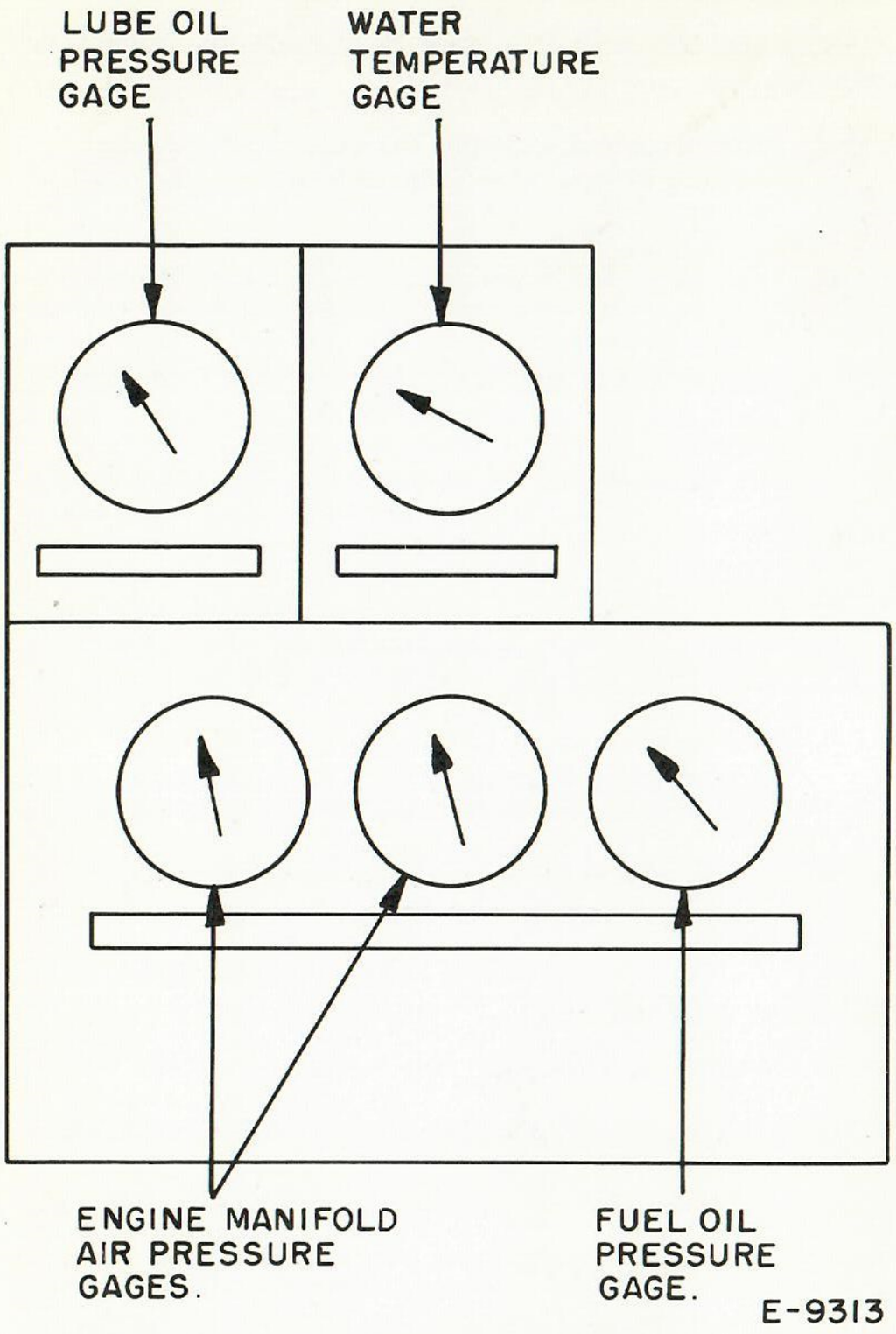
2. Color scale - indicates battery circuit condition.

   a. Red (first zone) - faulty or discharged battery.

   b. Silver - battery at low-voltage charge or being discharged. (Normal open circuit voltage is 64 volts.) Pointer stays in this band a short time after starting the engine.

   c. Green - battery receiving normal charge.

   d. Red (last zone) - battery being overcharged.



ENGINE GAGE PANEL
Fig. 5

ENGINE WATER TEMPERATURE GAGE (Fig. 5)

On "A" Unit

1. Located on A sidewall of locomotive near No. 1 end engine room door.

2. Indicates engine cooling water temperature. Should read 155 to 190 F.

On "B" Unit

Located on A sidewall of locomotive at No. 1 end near control compartment.

ENGINE MANIFOLD AIR GAGES (1 and 2)

On "A" Unit

1. Located on A sidewall of locomotive near No. 1 end engine room door. (Fig. 5)

2. Indicates pressure of air in either air manifold. Should read 15 psi at engine full speed and zero at idle speed.

On "B" Unit

Located on A sidewall of locomotive at No. 1 end.

FUEL OIL PRESSURE GAGE (Fig. 5)

On "A" Unit

1. Located on A sidewall of locomotive near No. 1 end engine room door.

2. Indicates pressure of fuel oil to engine. Should read 30 - 40 psi on diesel fuel or 60 - 70 psi on Bunker C.

On "B" Unit

Located on A sidewall of locomotive at No. 1 end.

GAGES AND INSTRUMENTS

AIR GAGES (Fig. 1)

On "A" Unit

Three gages are located in the operator's cab at the operator's position:

1. Left Gage - indicates main reservoir and equalizing air pressure.
2. Center Gage - indicates brake pipe and brake cylinder pressure.
3. Right Gage - indicates application pipe and suppression pressures.

On "B" Unit

One gage located at the hostler's station indicates brake pipe and brake cylinder pressure.

CONTROL AIR PRESSURE GAGE

1. On "A" Unit in nose compartment on A side of locomotive.
2. On "B" Unit - on air brake equipment rack near rear of locomotive.
3. Should indicate 90 psi.
4. Loss of control air pressure prevents operation of the electro-pneumatic devices of the locomotive and further locomotive movement.

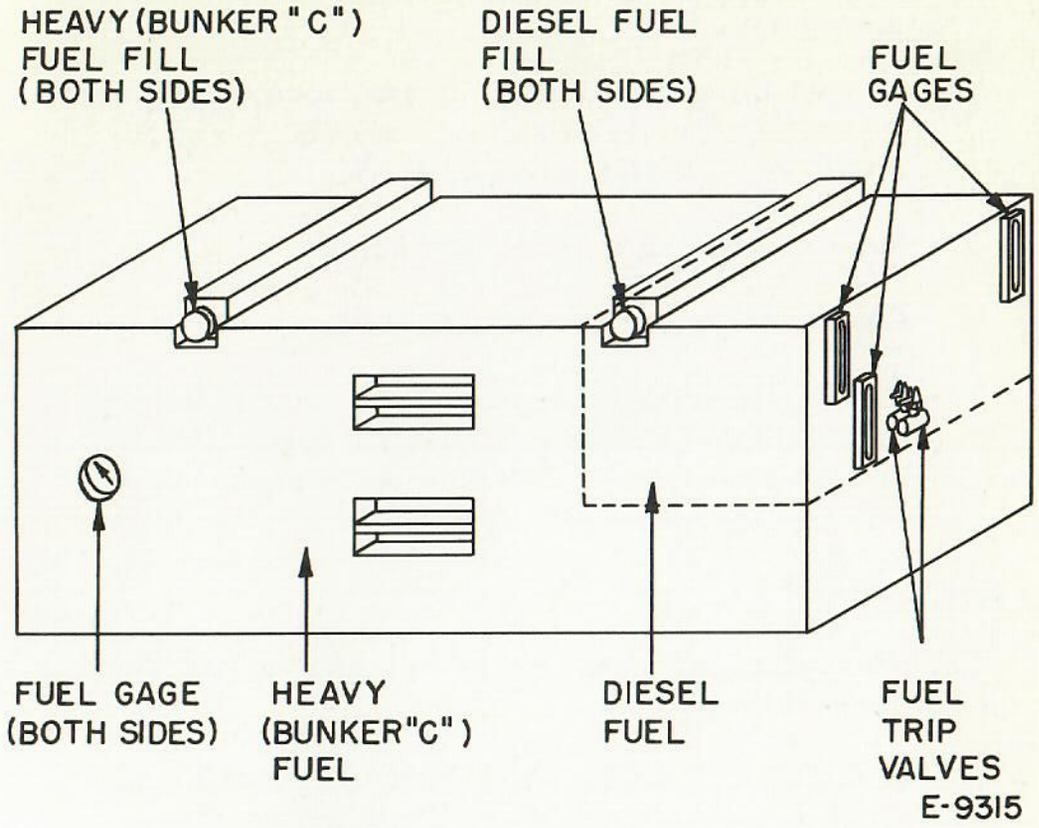
MAIN AIR RESERVOIR GAGE

On side of engine temperature control panel adjacent to compressor governor synchronizing control. Reads same pressure as illuminated duplex MR gage in operator's cab. Is used for setting compressor governor.

COMPRESSOR GAGE

A lube oil pressure gage is screwed into the gear oil pump assembly at the bottom of the air compressor.

PREPARATION FOR OPERATION



FUEL TANK
Fig. 6

BEFORE BOARDING LOCOMOTIVE

1. Check emergency fuel shut-off valves. If closed, raise valve stem and slip the crutch underneath the raised stem. (Fig. 6)

2. Close drain cocks on all main reservoirs. Close dirt collector drain cock. Open main reservoir cutout cock.

   Close cutout cocks at ends on train line hoses not connected to cars or another locomotive.

   NOTE: Straight-handled cocks are open when their handles are crossways to the pipe. Curved-handled cocks are open when their handles are parallel to the pipe.

3. Open brake-cylinder cutout cocks in air lines to both trucks.

4. Inspect for broken, worn, loose, or dragging parts (brake rigging, brake shoes, wheels, traction-motor commutator covers, etc.).

5. Make certain sand boxes are filled.

6. Check for leaks from outside piping.

7. Check fuel supply. Sight glasses located on both sides of fuel tank indicate fuel oil level. Dial pointer gages located on both sides of fuel tank indicate Bunker C level. (Fig. 6)

AFTER BOARDING

1. Remove rags, tools, etc. from moving parts and electric equipment.

2. Check diesel engine lubricating-oil supply. Oil level should be between high and low marks on bayonet gage. Be sure all oil drains are closed.

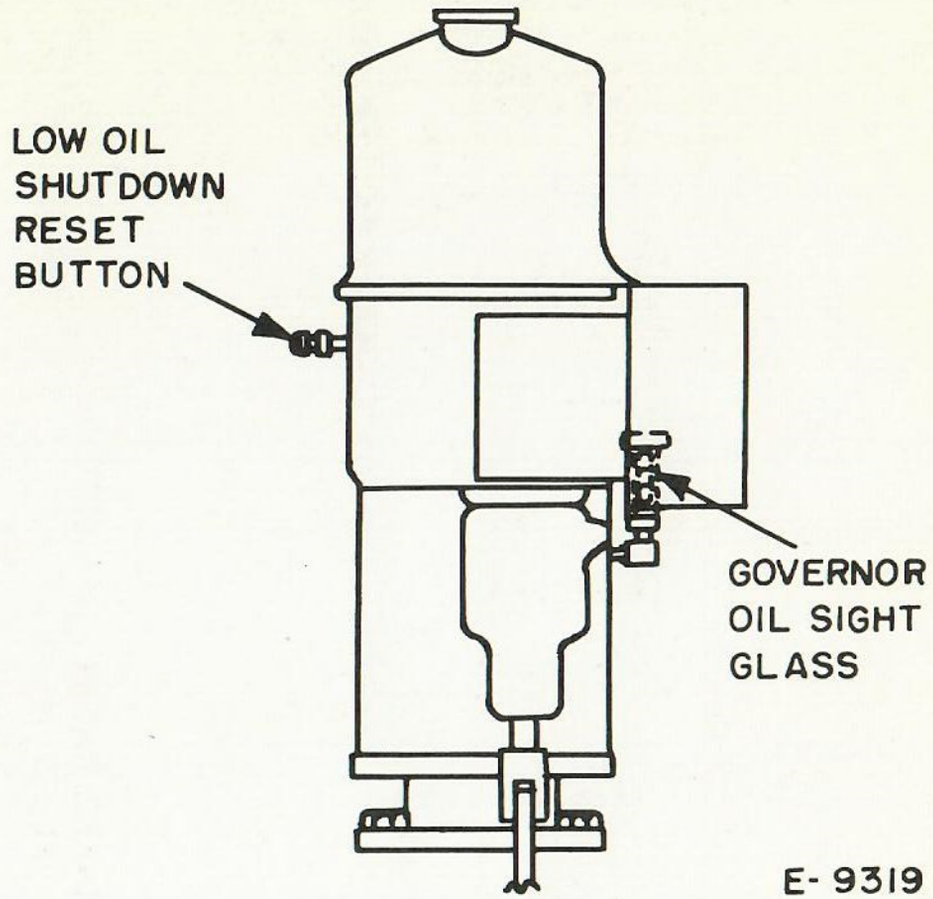
3. Check cooling-water supply. Proper water level is three-fourths the way up the length of the expansion tank sight glass. Be sure all water drains are closed.

4. Check diesel engine governor oil level to be visible between the marks on the sight glasses. (Fig. 7)

5. Be sure diesel-engine turning device is disengaged and locked.

6. Check air-compressor lubrication oil supply. Proper level is between high and low marks on bayonet gage.

7. Open compressor governor cutout cock, horn, window wiper, and bell ringer cutout cocks, sander cutout cocks, control air cutout cock, shutter control cutout cock and main reservoir cutout cock near air brake rack in nose compartment.



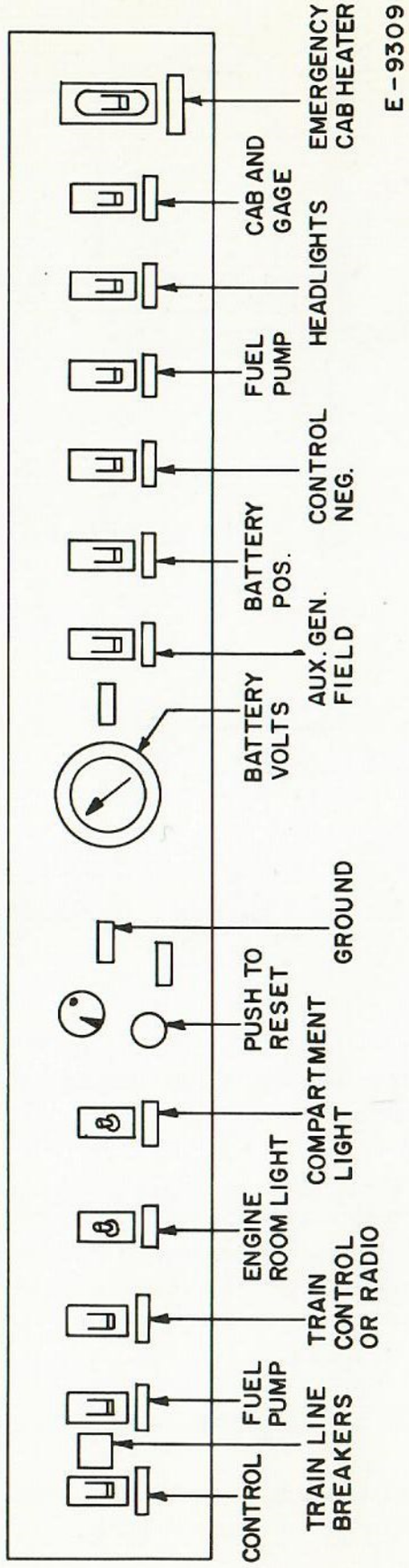
TYPE PG ENGINE GOVERNOR
Fig. 7

8. Close short-handled dead-engine cock on D24 control valve.

9. Install brake valve handles. Put automatic handle in RUNNING, and independent handle in RUNNING if the locomotive brakes are desired to apply as air is being pumped up. Open (turn horizontal) brake-pipe cutout cock below engineer's brake valve.

10. Open all switches and circuit breakers.

11. Place throttle handle in IDLE, selector handle OFF, and reverse handle OFF.



CIRCUIT BREAKER PANEL - A - UNIT

Fig. 8

12. If train signal system and/or automatic train control is being used, open signal line charging cutout cock and locomotive car discharge valve cutout cock.

STARTING ENGINE ON "A" UNIT

1. Perform operation in BEFORE BOARDING LOCOMOTIVE and AFTER BOARDING, above.

2. Close battery switch on rear of control compartment.

3. The ground relay cutout switch in the control compartment must be closed and the ground relay indicator must not be over red dot. If visible, see GROUND RELAY instructions under ALARMS AND SAFEGUARDS.

4. Close all circuit breakers (except train control) on control compartment panel. (Fig. 8)

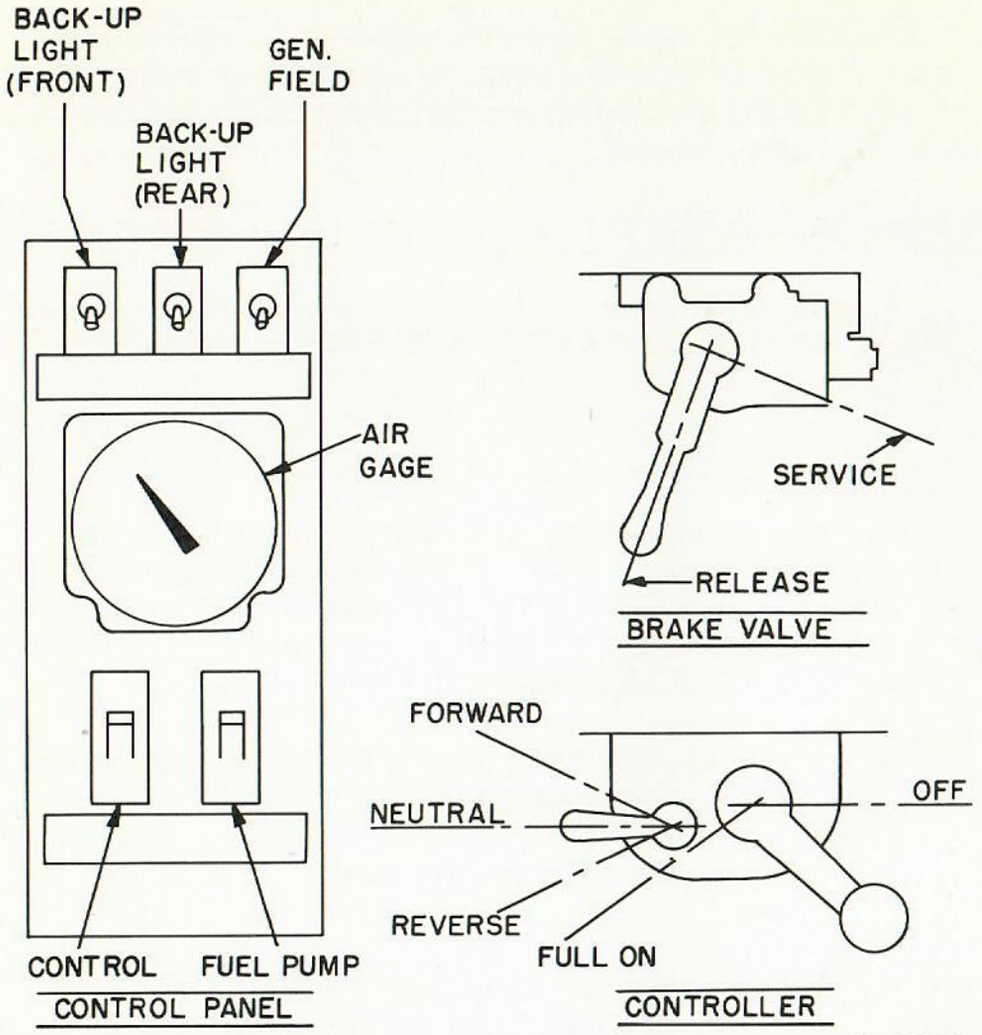
5. Inside control compartment on left wall, move lighting selector switch to BATTERY position.

   NOTE: For external power to lighting circuits move selector switch to WAYSIDE position.

6. Place fuel "selector" switch in proper position. (Fig. 2)

7. Allow fuel oil pressure to build up.

8. Turn engine control switch to IDLE. (Fig. 2)



HOSTLER'S STATION
Fig. 9

9. Push engine start button and hold there until diesel engine fires. Diesel engine will not crank if overspeed mechanism is tripped.

****
WARNING
****

RELEASE START BUTTON IF ALARM BELL RINGS AND LOW LUBE LITE COMES ON. DO NOT CONTINUE CRANKING ENGINE IF OIL PRESSURE DOES NOT BUILD UP. DO NOT ATTEMPT TO RECRANK ENGINE UNTIL IT HAS COME TO A COMPLETE STOP.

10. Do not discharge battery by repeated attempts to start. If first two or three tries are not successful recheck engine starting procedure.

11. Minimum engine lubricating oil pressure is 25 - 35 psi at full speed and 10 - 12 psi at idle speed.

12. When engine warms up to normal operating temperature of 160 - 180 F move engine control switch to RUN.

STARTING ENGINE ON "B" UNIT (Fig. 9)

1. Place controller handle at hostler's station in OFF.

2. Place reverse handle in OFF.

3. Close battery switch.

4. Close all circuit breakers on the control compartment panel.

5. Close the control and fuel pump breakers on the control panel at the hostler's station. (Fig. 9) Note when operating with an A unit these breakers should be in the "OFF" position.

6. Follow procedure outlined in item 5 through 10 in STARTING ENGINE ON "A" UNIT.

MOVING "B" UNIT WITH HOSTLER'S STATION

1. PRELIMINARIES

   a. Check gage for main reservoir air pressure.

   b. Have 90 pounds of control air pressure. Gage is located on side of control compartment.

   c. Apply brake valve handle in full service position and then move it to release position.

   d. Open brake valve cutout cock.

   e. Open reducing valve cock.

f. Place controlled emergency and charging changeover cutout cocks on D24 control valve in "Passenger" position.

g. Make brake application.

h. Release handbrake.

2. MANEUVERING "B" UNIT WITH HOSTLER'S STATION

a. Move reverse handle to forward or reverse position depending on direction of movement desired. Move handle toward side panel for forward movement; away from panel for reverse movement.

b. Close generator field breaker.

c. Release air brakes and advance throttle handle.

d. Move throttle handle to OFF and bring unit to full stop before reversing its movement.

3. LEAVING "B" UNIT AFTER OPERATION FROM HOSTLER'S STATION (NOT CONNECTED IN A TRAIN)

a. Apply hand brake.

b. Move brake valve handle to release position.

c. Close brake valve cutout cock.

d. Close reducing valve cutout cock.

e. Move brake valve handle to full service position and remove.

f. Turn engine control switch to OFF position.

g. Open fuel pump and control breakers at hostler's station.

h. Open all circuit breakers on control compartment panel.

i. Open battery switch.

4. LEAVING "B" UNIT AFTER OPERATION FROM HOSTLER'S STATION (All Air Hoses and Jumpers connected to "A" Unit)

See COUPLING LOCOMOTIVES in next section.

COUPLING LOCOMOTIVE UNITS

When making up a train using A and B units various controls must be properly positioned.

1. All switches, circuit breakers and cutout cocks in the leading A unit should be in the same position as when operating a single A unit.

2. Place the Rotair valve on the leading "A" unit in FRGT or PASS position according to instructions in Para. 7 under AIR BRAKES.

3. On the trailing A unit, all switches and circuit breakers must be ON as in the leading A unit with the exception of the control and fuel pump breaker on the control compartment and the generator field breaker on the controller switch box. These must be in the OFF position. The throttle handle must be in IDLE. Selector handle in OFF, and the reverse handle placed in OFF and removed. Place Rotair valve in FRGT LAP or PASS LAP according to position of Rotair valve in leading A unit.

   Place Automatic Brake Valve handle in RUNNING position and Independent Brake Valve handle in RELEASE position and remove both handles.

4. On B units, all switches and circuit breakers should be in the same position as when moving a single B unit with the exception of the control, fuel pump and generator field breakers at the hostler's station all of which must remain in the

OFF position. The brake valve cutout cock and the reducing valve cutout cock at the hostler's station should be closed. The brake valve handle and reverse handle should be removed.

5. On the D24 control valve set the charging changeover cock in the same position on all units as the Rotair valve on the leading A unit.

6. On the D24 control valve on B units, set the controlled emergency cutout cock in the same position as the charging changeover cock - F for freight and P for passenger.

7. See that air hoses and multiple-unit jumpers are properly connected and the air line cutout cocks are open. Plug the main reservoir actuating pipe and independent and release pipe connections on the side not being used.

FASTER AIR PUMPING

If air pressure (in brake system) is down, it can be charged to proper operating pressure quickly, as follows:

1. Have generator field switch on controller switch box in OFF position.

2. Place reverse handle in OFF and selector handle in position No. 1.

3. Move throttle handle up to notch 4 or 5.

BEFORE MOVING A TRAIN

1. Install brake valve handles and reverse lever in operating cab of leading A unit.

2. Check main reservoir air pressure.

3. Check control air pressure - normal 90 psi.

4. Place brake pipe cutout cock in OPEN position.

5. Make brake application. See that handbrakes on all units are released.

6. The dead engine cock located on the D24 control valve must be in LIVE position on all units.

7. Test sanders. Check all units.

8. Make air-brake test. Check all units. Make sure that all brake cylinder cutout cocks are open.

9. Have at least 120 F water temperature, if possible, before notching up. See ENGINE WATER TEMPERATURE GAGE.

OPERATING PROCEDURE

MOVING A TRAIN

1. Close generator field switch on controller switch box.

2. Move reverse handle to FORWARD or REVERSE position, depending on direction of movement desired.

3. Move selector handle to position 1.

4. Depress safety control pedal.

5. Release brakes.

6. Advance throttle handle. Move handle as rapidly as possible into throttle notch which starts locomotive movement. In some cases it may be necessary to advance throttle handle as far as 7th or 8th notch.

WHEEL SLIP

1. Wheel slip is indicated by a warning light and buzzer. Power to the traction motors is automatically reduced when a wheel slip occurs.

2. With the sanding timer switch in ON position an automatic application of sand is applied to the rails.

3. With the sanding timer switch in OFF position sanding of the rails is done by use of the independent air brake valve handle.

4. Sand can be applied to the rails with the sander timer switch in either OFF or ON position by use of the automatic air brake valve handle.

TRANSITION

1. These locomotives are equipped with automatic transition. During multiple-unit operation with other locomotives not so equipped selector handle must be moved according to the needs of the other locomotives. Transition on these locomotives will still be automatic.

2. Motor connections and speeds at which transitions occur on the locomotive are listed below:

Motor Connections	MPH	CPS
SER-PAR Fld. Shunting Step #1	14.4	14.1
SER-PAR Fld. Shunting Step #2	17.2	16.8
PARALLEL	19.6	19.2
PARALLEL (Shunted Fields)	37.4	36.6

3. When operating these locomotives with others not equipped with automatic transition:

   a. When starting the train have the selector handle in position 1.

   b. As speed of train increases, move the selector handle into higher notches according to needs of other units.

   c. As speed decreases, move selector handle to lower notches according to the needs of other units.

STOPPING A TRAIN

1. Return throttle handle to IDLE. Stop train using dynamic brakes, air brakes or a combination of both.

2. If leaving operator's position move selector and reverse handles to OFF.

REVERSING LOCOMOTIVE

1. Bring locomotive to a full stop.

2. Move reverse handle to opposite direction.

3. Release brakes.

4. Advance throttle handle.

SHUTTING DOWN DIESEL ENGINE

A Unit

1. Open generator field breaker on controller switch box.

2. Move engine control switch to OFF position.

3. Apply hand brake and release air brakes.

4. Open all other switches and circuit breakers on controller switch box and control compartment panel.

5. Open battery switch.

B Unit

1. Open generator field breaker at hostler's station.

2. Move engine control switch to OFF position.

3. Apply hand brake.

OPERATING PROCEDURE

4. Open all other switches and circuit breakers at control compartment panel.

5. Open battery switch.

SEPARATING UNITS

1. Before separating or closing cocks between units, make a full service automatic application from the lead unit.
2. Set the reducing valve at or near the brake pipe pressure carried on the leading A unit.
3. Close all end cocks on ends of units and remove multiple-unit jumpers.

MISCELLANEOUS OPERATING INSTRUCTIONS

CHANGING OPERATING ENDS

1. At operating station being cut-out.

   a. Make a 20 pound brake pipe reduction with the automatic brake valve handle and then move the handle to LAP position.

   b. Move the independent brake valve handle to RELEASE. See that brakes are still applied.

   c. Close the brake pipe cutout cock (vertical position).

   d. Place the Rotair valve in either FRGT LAP or PASS LAP according to instructions of Para. 7 under AIR BRAKES.

   e. Move the automatic brake valve handle to RUNNING position and remove both air brake handles.

MISCELLANEOUS OPERATING INSTRUCTIONS

   f. Place reverse handle in OFF and remove. Selector handle must be in OFF and throttle handle in IDLE.

   g. On the controller switch box, open generator field switch. On the control compartment panel open the control breaker. Leave fuel pump breaker closed.

2. On operating station being cut-in.

   a. Put reverse handle in place and leave in OFF position.

   b. Insert automatic and independent brake valve handles.

   c. Place Rotair valve in place according to instructions of Para. 7 under AIR BRAKES.

   d. Move independent brake valve handle to APPLICATION position.

   e. Open brake pipe cutout cock.

   f. Move automatic brake valve handle to EMERGENCY and then back to LAP.

   g. When changing feed valve pressures, depress the independent brake valve handle in FULL APPLICATION position for about 8 seconds to avoid possibility of an overcharge.

   h. Move automatic brake valve handle to RUNNING or RELEASE position.

   i. Close control and fuel pump breakers on control compartment panel.

   j. OPEN fuel pump breaker on operating end being cut-out.

   k. Close generator field breaker on controller switch box.

1. Place foot on safety control pedal and release independent brake.

EMERGENCY ENGINE SHUTDOWN

1. Emergency Engine Shut-Down Button

   a. A red push button located on the controller switch box shuts down all engines operating on a train whether single or multiple unit. Use this button for emergency use only; perform normal shutdowns with engine-control switch. Throttle handle must be in IDLE.

   b. To start engines for multiple-unit operation after shut-down by emergency stop button:

      (1) Turn engine-control switch to OFF on all units before attempting to start any unit during multiple-unit operation.

      (2) Push black engine run button to release red engine stop button.

      (3) Start engines in the usual manner.

2. Emergency Fuel Shut-Off Valves

   Located adjacent to the fuel tanks and has trip handles at the operator's station and at each side of the locomotive.

OPERATING THROUGH WATER

Do not exceed two or three mph if there is water above the rail head. Do not pass through water over three inches above rail head.

PASSING OVER RAILROAD CROSSINGS

Reduce throttle by one half until all locomotive units are over railroad crossing.

PUTTING DIESEL ENGINE "OFF OR ON THE LINE" DURING M-U OPERATION

Diesel engine can be cut off or put on the line by use of engine-control switch.

TOWING DEAD LOCOMOTIVE (ONLY BRAKE PIPE HOSE CONNECTED)

In freezing weather drain cooling water system or provide a safe anti-freeze solution. If a dead unit is in multiple with other units which are live the dead unit should be set up the same as a live trailing unit. If the dead unit is being towed or is part of a train and not considered as part of the locomotive units the brake equipment should be set up as a dead unit as follows:

A Unit

1. Close the brake pipe cutout cock and remove automatic brake valve handle in RUNNING position.

2. Place dead engine cock in DEAD position on D24 control valve.

3. Place charging changeover cock in PASS position on D24 control valve.

4. Remove or keep independent brake valve handle in RELEASE position.

5. Place Rotair valve in PASS position.

6. Set safety valve on control valve down to about 25 pounds.

B Unit

1. Place dead engine cock in DEAD position on D24 control valve.

2. Open brake valve cutout cock at hostler's station.

3. Remove brake valve handle in FULL APPLICATION position, then move brake valve stem to RELEASE position using reverse side of brake valve handle.

4. Place charging changeover and control emergency cocks in PASS position.

5. Close reducing valve cutout cock at hostler's station.

6. Open end cocks on actuating and application release pipes or one end of unit.

7. Set safety valve on control valve down to about 25 pounds.

OPERATING WITH LEAD UNIT SHUT DOWN

1. Turn engine control switch to OFF.

2. Close battery switch on dead unit.

3. Close battery, control, control negative breakers and fuel pump switch on control compartment panel. Close any lighting breakers only if required. Open all other circuit breakers.

   Close generator field switch on controller switch box.

   Dynamic braking will be inoperative on the lead unit. Use of dynamic braking with any engine dead in a locomotive unit is not recommended.

   NOTE: With engine shut down, battery charging is inoperative. Battery voltage will be weakened enough in a few hours to prevent further locomotive operation.

OPERATING WITH DEAD BATTERY ON LEAD UNIT (Without headlight)

On lead unit

1. Turn engine control switch to OFF.

2. Open battery switch.

3. Open all circuit breakers on control compartment panel.

4. Close generator field switch on controller switch box.

On trailing unit (A or B)

1. Close fuel pump and control breakers on control compartment panel on hostler's control stand.

2. Make sure all other breakers and generator field switch are closed.

OPERATING WITH DEAD BATTERY ON LEAD UNIT (With headlight)

On lead unit

1. Turn engine control switch to OFF.

2. Open battery switch.

3. Close generator field switch on controller switch box.

4. Open all breakers on control compartment panel except headlight and control breakers.

On trailing unit (A or B)

1. Close fuel pump and control breakers on control compartment panel or hostler's station.

2. Make sure all other breakers and generator field switch are closed.

DRAINING COOLING SYSTEM

ABOVE FREEZING WEATHER

For weather above freezing, the entire Diesel Engine water system may be drained by opening the main water drain valve located on the right side of the engine near the air compressor.

SUB-FREEZING WEATHER

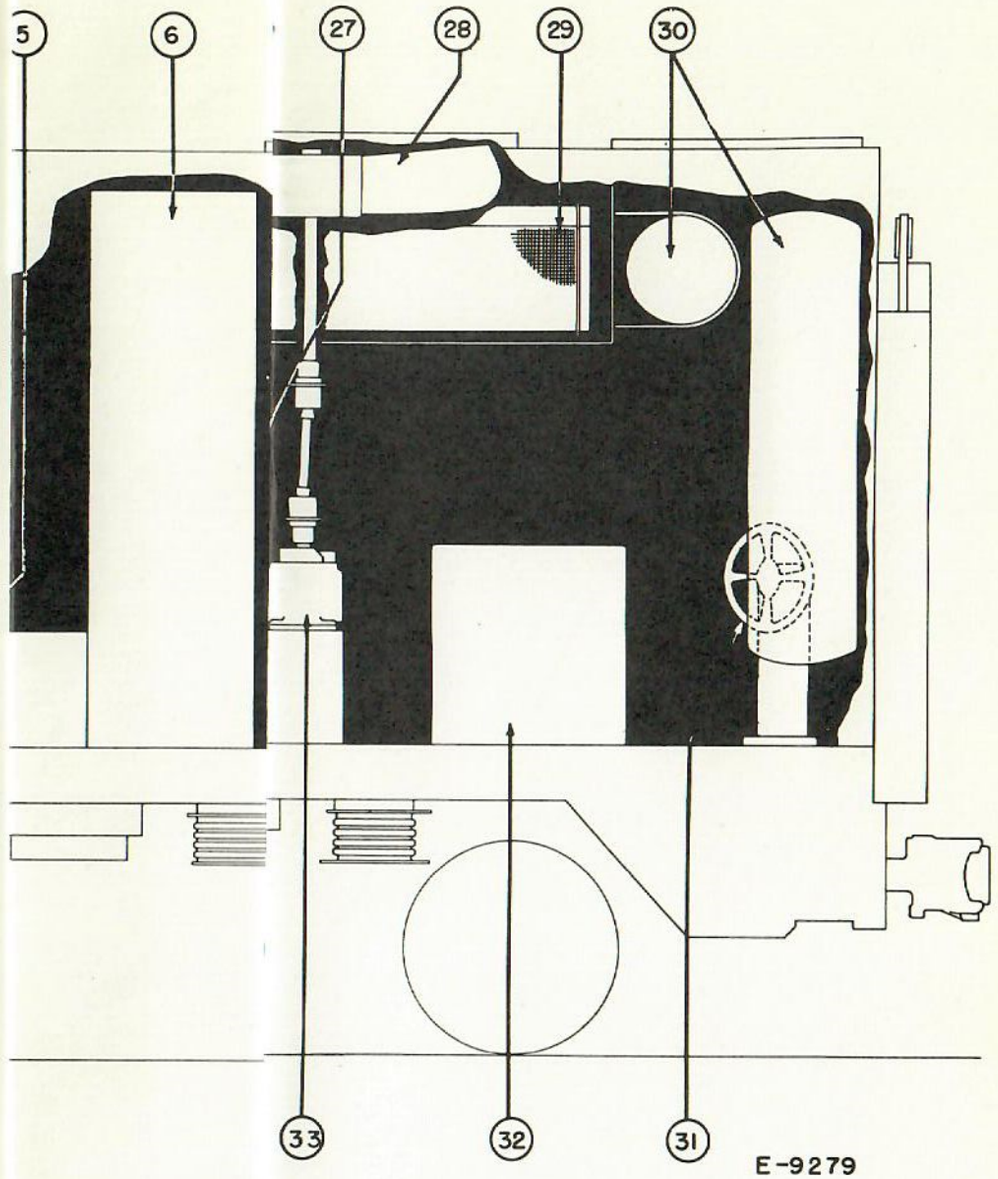
To prevent damage to cooling system components in sub-freezing weather, drain water system as follows:

1. Open main water drain valve located on right side of engine near air compressor.

2. Remove water drain plugs from both engine intercoolers. (Drain plug located in mounting base of intercooler.)

3. Remove drain plug from engine water pump housing.

4. Remove drain plugs from both cab heaters.



LOWER
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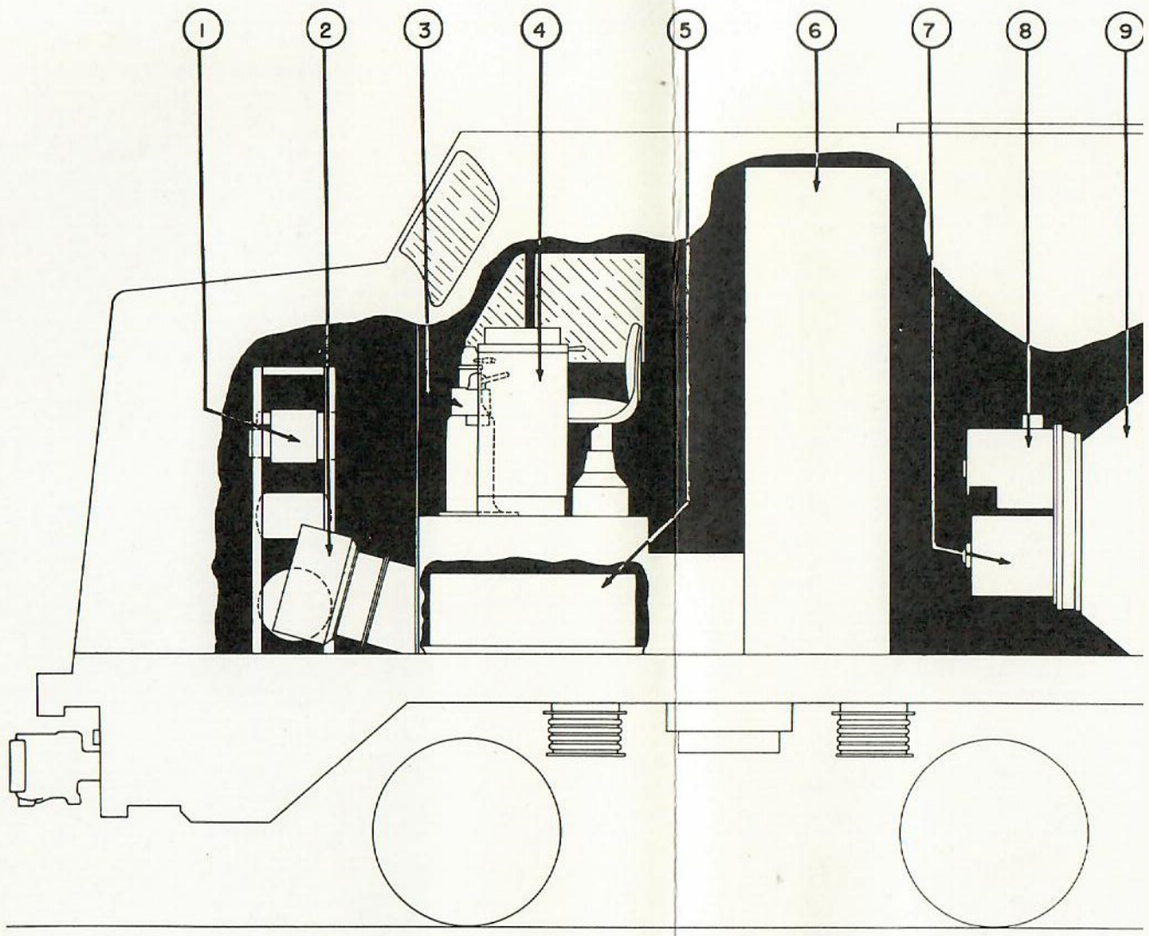
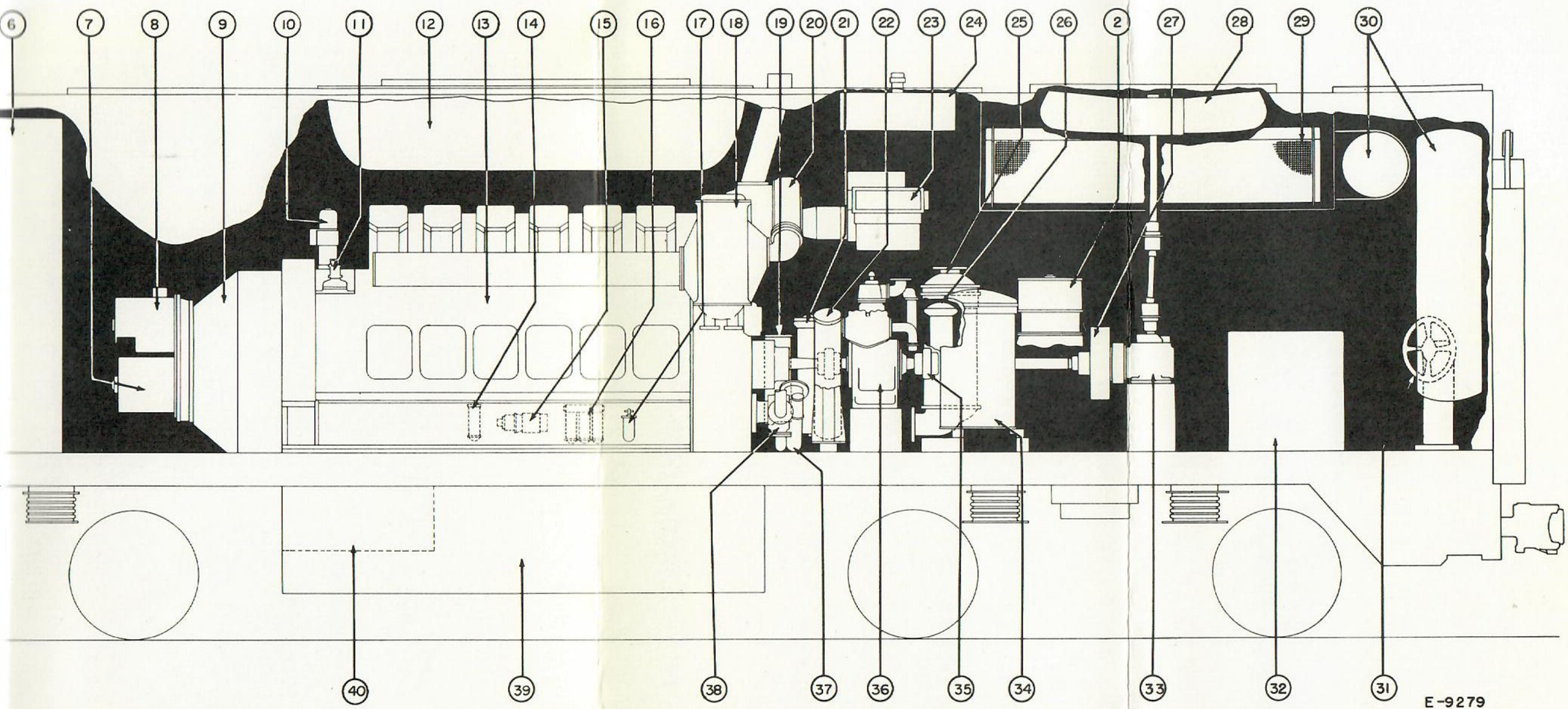
MENT
TORS (2)
TOR

HANDBRAKE
BALLAST
GEAR UNIT
LUBE OIL FILTER
FLEXIBLE COUPLING
AIR COMPRESSOR
WATER PUMP
LUBE OIL PUMP
HEAVY FUEL TANK
DIESEL FUEL TANK

LOCATION OF APPARATUS (A-UNIT)
Fig. 10

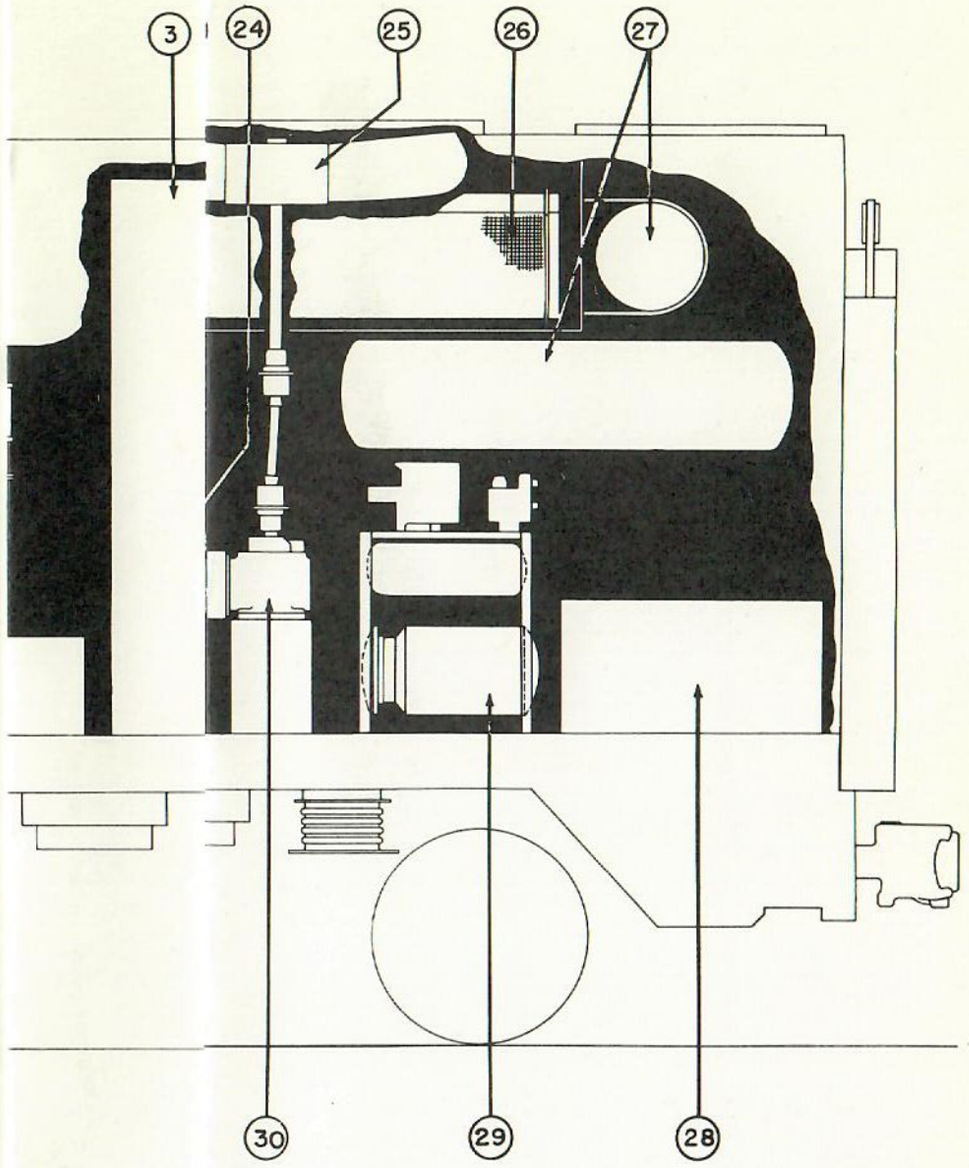


1. AIR BRAKE RACK
2. TRACTION MOTOR BLOWER
3. AIR BRAKE STAND
4. MASTER CONTROLLER
5. BATTERIES
6. CONTROL COMPARTMENT
7. AUXILIARY GENERATORS (2)
8. EXCITER
9. TRACTION GENERATOR
10. ENGINE GOVERNOR
11. ENGINE O
12. BRAKING
13. DIESEL EN
14. PRIMARY
15. BOOSTER
16. SECONDAR
17. ENGINE LI
18. INTERCOO
19. HEAVY FU
20. TURBOCHA



11. ENGINE OVERSPEED GOVERNOR
12. BRAKING RESISTORS
13. DIESEL ENGINE
14. PRIMARY DIESEL FUEL FILTER
15. BOOSTER FUEL PUMP
16. SECONDARY DIESEL FUEL FILTER
17. ENGINE LUBE OIL FILL WITH DIPSTICK
18. INTERCOOLERS (2)
19. HEAVY FUEL HEATER
20. TURBOCHARGER
21. PRIMARY HEAVY FUEL FILTER
22. SECONDARY HEAVY FUEL FILTER
23. OIL BATH AIR FILTER
24. WATER EXPANSION TANK
25. LUBE OIL COOLER
26. LUBE OIL STRAINER
27. FLYWHEEL
28. FAN
29. RADIATORS
30. MAIN AIR RESERVOIRS
31. HANDBRAKE
32. BALLAST
33. GEAR UNIT
34. LUBE OIL FILTER
35. FLEXIBLE COUPLING
36. AIR COMPRESSOR
37. WATER PUMP
38. LUBE OIL PUMP
39. HEAVY FUEL TANK
40. DIESEL FUEL TANK

LOCATION OF APPARATUS (A-UNIT)
Fig. 10



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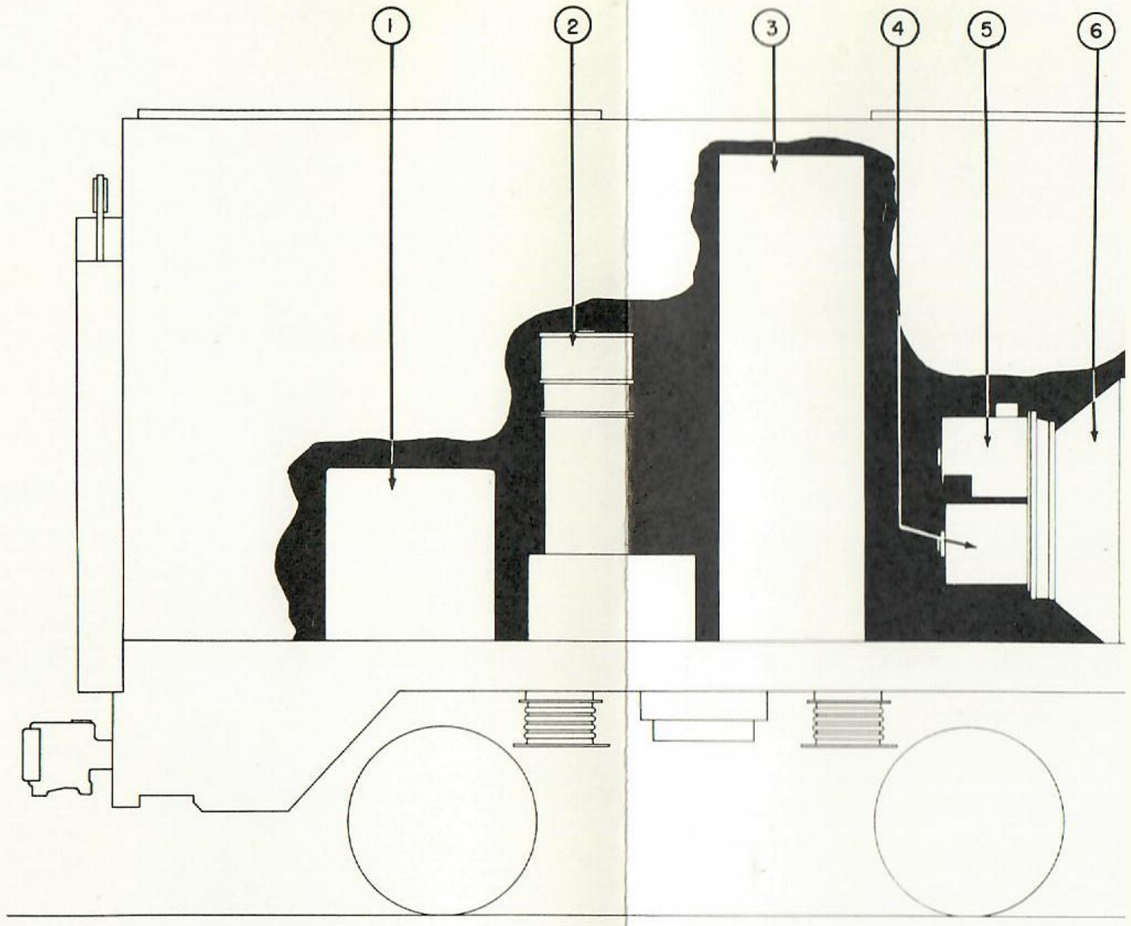
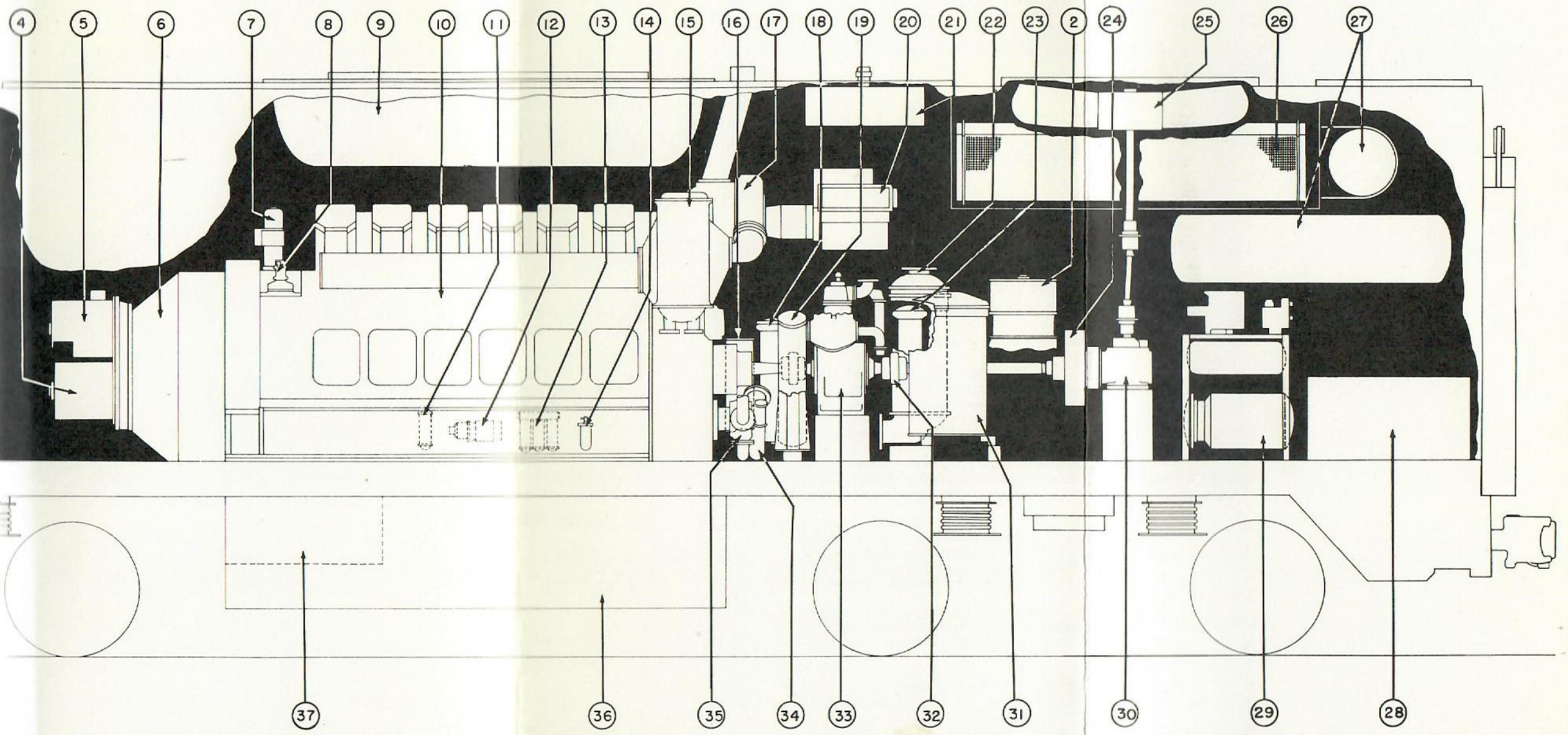
28. BATTERIES
29. AIR BRAKE RACK
30. GEAR UNIT
31. LUBE OIL FILTER
32. FLEXIBLE COUPLING
33. AIR COMPRESSOR
34. WATER PUMP
35. LUBE OIL PUMP
36. HEAVY FUEL TANK
37. DIESEL FUEL TANK

OR BLOWER
ARTMENT
ERATORS (2)
RATOR
OR
EED GOVER
ORS

LOCATION OF APPARATUS (B-UNIT)
Fig. 11



1. BALLAST
2. TRACTION MOTOR BLOWER
3. CONTROL COMPARTMENT
4. AUXILIARY GENERATORS (2)
5. EXCITER
6. TRACTION GENERATOR
7. ENGINE GOVERNOR
8. ENGINE OVERSPEED GOVERNOR
9. BRAKING RESISTORS
10. DIESEL F
11. PRIMARY
12. BOOSTER
13. SECONDA
14. ENGINE
15. INTERCO
16. HEAVY F
17. TURBOC
18. PRIMARY



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10. DIESEL ENGINE
11. PRIMARY DIESEL FUEL FILTER
12. BOOSTER FUEL PUMP
13. SECONDARY DIESEL FUEL FILTER
14. ENGINE LUBE OIL FILL WITH DIPSTICK
15. INTERCOOLERS (2)
16. HEAVY FUEL HEATER
17. TURBOCHARGER
18. PRIMARY HEAVY FUEL FILTER
19. SECONDARY HEAVY FUEL FILTER
20. OIL BATH AIR FILTER
21. WATER EXPANSION TANK
22. LUBE OIL COOLER
23. LUBE OIL STRAINER
24. FLYWHEEL
25. FAN
26. RADIATORS
27. MAIN AIR RESERVOIRS
28. BATTERIES
29. AIR BRAKE RACK
30. GEAR UNIT
31. LUBE OIL FILTER
32. FLEXIBLE COUPLING
33. AIR COMPRESSOR
34. WATER PUMP
35. LUBE OIL PUMP
36. HEAVY FUEL TANK
37. DIESEL FUEL TANK

LOCATION OF APPARATUS (B-UNIT)
Fig. 11